REMARKS

The application now contains claims 1-8. All claims are under examination.

Support

Support for new claims 3-6 can be found in the specification as filed on page 20 at lines 7-10.

Support for new claims 7 and 8 can be found in the specification as filed on page 19 at about line 5.

Issues under 35 U.S.C. 103

The rejection in paragraph 2 of claims 1 and 2 as obvious over EP 1 125 973 (Sato) in view of U.S. 4,789,564 (Kanner) is traversed. In order to best understand how the claimed invention distinguishes over the cited references it is useful to first consider the significant features of the present invention.

Features of the Present Invention

The present invention relates to a method of treating silica filled rubber in the cured state, and more particularly, a treating method for producing cured rubber having improved compression set and which is suitable for use as O rings and similar parts in fuel, lubricant and working fluid systems of automobiles and the like.

According to the invention, when a cured rubber made of a curable rubber composition comprising a curable organopolysiloxane or perfluoropolyether group-containing organosilicon compound, a curing agent therefor, and a silica filler having a mean particle size of 0.001 to 10 μm, is post treated in a vapor of a hydrolyzable aminosilane or amidosilane having a Si-N bond, there is obtained cured rubber having significantly improved compression set as proved in the Examples of the present specification.

In addition, the inventive method is advantageous in many aspects. That is, the amount of hydrolyzable aminosilane or amidosilane used, which is the drawback of certain previous proposals, can be reduced to the necessary minimum level. The degree of swelling of cured rubber during the post treatment is low facilitating removal of the swelling liquid.

Thus, with the treating method of the present invention, cured rubber parts having superior cured properties are manufactured in an efficient manner.

The Cited References

Sato discloses a cured rubber made of a curable rubber composition comprising a curable organopolysiloxane, a curing agent therefor, and a silica filler having a mean particle size of 0.001 to 10 μm, the cured rubber being post treated with a hydrolyzable aminosilane or amidosilane having a Si-N bond.

Sato does disclose the post treatment of the polysiloxane rubber with aminosilane or amidosilane. However, in the method of Sato, the cured rubber is post treated by immersing it in a treating solution which contains the hydrolyzable aminosilane or amidosilane.

As discussed in the present specification, this method achieves an improvement in compression set, but some problems remain unsolved. At the end of immersion, the cured rubber has been swollen. In order for the cured rubber to resume the original shape, the swelling liquid must be removed. This requires a cumbersome operation. There is a chance of making the properties of the cured rubber worse under the stress due to swelling. Beside, it is required to immerse the rubber entirely into the solution, so that large amounts of hydrolyzable aminosilane or amidosilane liquid are necessary. Therefore, a further improvement is desired in this respect.

The present invention overcomes such prior art problems by the method of post treating 100 parts by weight of the cured rubber with 0.5 to 30 parts by weight of a hydrolyzable aminosilane or amidosilane having a Si-N bond in vapor form. The inventive method eliminates the stress on the rubber caused by swelling and can treat the rubber completely, including its interior, with a minimal amount of the silane compound.

Even though Sato teaches the treatment of cured rubber with the silane compound, he fails to teach or suggest the inventive method and the features thereof.

Kanner provides an aminosilane treatment for rendering surfaces water-repellent which takes place in the liquid or vapor form of aminosilane. Kanner relates to the treatment of substrates with hydroxyl containing surfaces such as filter paper with hydridoaminosilanes to impart water repellency to the treated surface.

The Examiner alleges that those skilled in the art would have been motivated by the teachings of Kanner to apply the silane in Sato in vapor form rather than direct contact with a silane solution with a reasonable expectation of success in obtaining a surface treated rubber substrate.

However, Kanner is directed only to the water repellent treatment of the hydroxyl containing substrate surface and fails to teach or suggest the treatment of the cured rubber of the claimed invention. More specifically, the present invention is not concerned with merely surface treatment of the rubber substrate as the Examiner alleges. In the inventive method of treating the cured rubber with the silane compound, it is inadequate to treat only the surface of the cured rubber. It is required to treat the interior of the cured rubber so as to obtain improvement in compression set.

Although Kanner discloses the aminosilane treatment in vapor form, it is concerned only with surface treating the substrate such as paper, textiles, cellulosics, and inorganic substrates such as silica or alumina to make the surface thereof water repellent without deteriorating its strength or adversely affecting fraying. There is no disclosure of treating cured rubber to improve its compression set.

Therefore, one skilled in the art is not motivated to combine Sato and Kanner to arrive at the inventive method which produces the cured rubber having excellent compression set. References which do not recognize a problem can hardly suggest a solution.

All that one skilled in a art would expect from the combination of the cited references is a surface treated rubber substrate having water repellency. The cured rubber having remarkably improved compression set, as described in the present invention, cannot be expected.

Accordingly, the present invention and the features thereof are not obvious over the cited references.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact David R. Murphy (Reg. No. 22,751) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment(s):

(Rev. 02/12/2004)